

Title: Modeling Linear Relationships

Brief Overview:

In this unit, students will work with situations that can be modeled using linear functions. Students will draw connections between a situation, equation, graph, and table. By understanding how the concept of slope and y-intercept show up in different representations, students will gain fluency in moving between the various representations. Representing a situation as an equation, graph, and table will also give students the tools to make predictions about future (or past) behavior. Students start with modeling fairly concrete situations and move towards working with more abstract equations and graphs presented in non-contextual settings.

NCTM Content Standard/National Science Education Standard:

- Understand relations and functions and select, convert flexibly among, and use various representations for them
- Analyze functions of one variable by investigating rates of change and intercepts.
- Identify essential quantitative relationships in a situation and determine the class or classes of functions that might model the relationships.
- Draw reasonable conclusions about a situation being modeled.

Grade/Level:

Grade 8 – 10/Pre-Algebra, Algebra 1

Duration/Length:

Three 45-minute class periods

Student Outcomes:

Students will:

- Take a “real-world” situation and determine an appropriate slope and y-intercept that can be used to write an equation to model the situation. From the equation, be able to construct a table of values and a graph that illustrates the situation.
- Become familiar with the slope-intercept form of a linear equation. Given a linear equation in slope-intercept form, be able to represent the equation using a graph and a table of values.

Materials and Resources:

- Index cards
- Envelopes
- Copies of worksheets

- What do you know?
- Slope is Change
- The Perfect Match
- Now It's Your Turn
- STOP
- Pictures → Table → Graph → Equation
- Make Me a Match
- Round Table Activity
- Practice Makes Perfect
- Round Table Summative Assessment

Development/Procedures:

Day 1

- Pre-assessment
Give each student a copy of the five-question multiple-choice activity, "What do you know?". Allow 3–5 minutes for students to complete individually. Solicit student responses using pinch cards or Activotes® (used with Promethean Boards) for each question and provide feedback and review as needed.
- Exploration and Explanation
Guide the students through the "Slope is Change" worksheet. Discuss with the students the concept of change through images, focusing on the difference between positive and negative slope to predict future behavior, analyze prior trends, and interpolate intermediate values. Note also that each series of pictures represents an increasing or decreasing linear relationships in various real-world situations. Ask the following questions as the students complete the worksheet: "Describe what is happening."; "Explain what is changing."; "Analyze what the change depends on."; "Justify how and why you drew your picture."
- Application
Divide the class into pairs. Cut up the cards from "The Perfect Match", prior to the start of class, and place them into envelopes. Give each student pair one envelope, and set a time limit of five minutes for the students to work together to match each situation with the correct graph. Hint to the students to be mindful of the steepness or magnitude of the slope of each graph. Discuss answers as a class, having the students share their thinking and logic.

Maintain a "bin" for questions or observations that will be discussed in the following days.

- Differentiation
 - Enrichment

Have the students complete the “Now It’s Your Turn...” worksheet in groups of three or four. Assign roles to each person, such as a recorder for the story column; a recorder for the image column; a recorder for the graph column.
 - Re-teach

Teacher will monitor student progress in their groups and re-teach on an individual basis for the groups that do not understand. This will allow students to try it on their own first.
- Assessment

Give each student a copy of the “STOP” worksheet, where the students will create their own situation with a story, a set of images, and a graph.

Day 2

- Exploration and Explanation (intertwined)

Give each student a copy of the “Pictures → Table → Graph → Equation” scaffold notes sheet. Note that all the sequences of images are repeated from day 1, but with values for independent and dependent variables.

Begin working through the first scenario as a class. Fill in the tables with information directly from the pictures. Renumber the graphs to reflect the scale from the second table. Emphasize that the axes identify where $x = 0$ and $y = 0$, which are the y - and x -intercepts, respectively. Relate the beginning value with b , y -intercept, and $x = 0$. Have the students calculate the rate of change, either by counting on the graph, using the tables, or applying the slope formula. Write the equation by substituting in values for b and m .

Model the first two examples, guide the second example, and have students work on fourth example independently. Invite various students to share their responses for each part of example four.
- Application

Cut up the cards from “Make Me a Match” prior to the start of class, and place the cards into envelopes. Divide the class into groups, and give each group one envelope. Allow five minutes to work together to match each graph, equation, description, and scenario. Create a transparency of the cards, and invite a student to match the transparency cards. Discuss answers as a class.

Maintain a “bin” for questions or observations that will be discussed in the following days.

- Differentiation
 - Re-teach/Enrich

Divide the class into groups of three. Assign letters “A”, “B”, and “C” according to following guidelines:

 - Students beginning with worksheet A will encounter medium–difficulty questions.
 - Students beginning with worksheet B will encounter difficult questions.
 - Students beginning with worksheet C will encounter easiest questions

Distribute the “Round Table” activity according to the division of the groups. Explain the following directions to the students:

 - Each student, starting with their worksheet, completes the “Person 1” box.
 - Passing the papers to the right, each student checks the work of “Person 1.” Then, the student completes the “Person 2” box on the new worksheet.
 - Continue for one final round, where the third student checks the work of the first two students, and then completes “Person 3” box.

Day 3

- Exploration

Assign the “Try this” question from the worksheet, “Practice Makes Perfect...” as a warm-up. Prompt the students with one of the following suggestions, if necessary:

 - “Can you write an equation for this situation?”
 - “What patterns do you see?”
 - “Can you identify a starting point?”
 - “Can you identify what is changing?”

Discuss answers as a class.
- Explanation

Work through the first question as a class. Emphasize how the equation and the graph can be used to answer various questions about the scenario. Lead the students to develop the connection between the x - and y -intercepts and how to interpret them in the context of the situation.

Give the students a few minutes to attempt the second question. Divide the class into pairs for a “Think-Pair-Share”, giving each group a few minutes to compare and discuss their answers. Listen to the discussions and make note of what students understand well, and what ideas still need to be clarified. Use this information to guide a whole–class discussion to reinforce the work done and to clarify any misconceptions.

- Differentiation (Reteach/Enrichment)
Assign “Linear Relationships” Project to each student. Explain the parameters of the project and the rubric. Show examples of previous projects and how it may look or where to find examples. Allow students a few minutes to brainstorm 5 places they could find type of line (positive slope and negative slope). After the brainstorming, have student share out their ideas of where to find examples of linear relationships in the real world. This will help the students that do not fully understand by giving them multiple examples. Also, it allows the teacher to reject any ideas that are not linear and explain why they are not.

Summative Assessment:

The summative assessment for this unit will be a round table activity. Divide the class into groups of three. Assign letters “A”, “B”, and “C” according to following guidelines:

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- Students beginning with worksheet B will encounter difficult questions.
- Students beginning with worksheet C will encounter easiest questions

Distribute the “Round Table” activity according to the division of the groups. Explain the following directions to the students:

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County/Jurisdiction: Montgomery County, MD

What Do You Know?

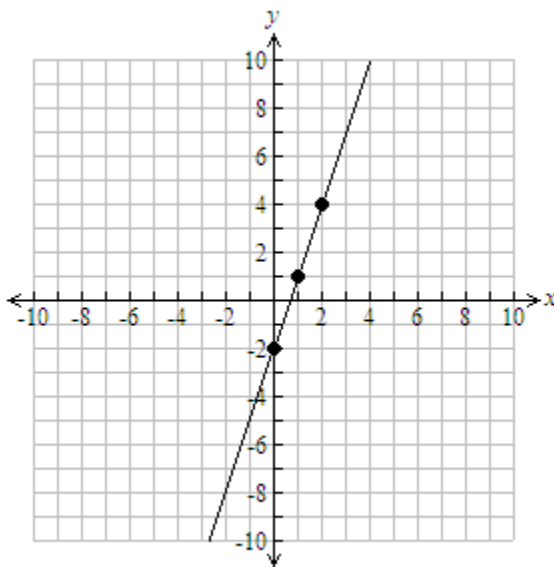
Name: _____

1. What is the slope of the table below?

x	-1	1	3	5
y	16	10	4	-2

- A. 3 B. $-\frac{1}{3}$ C. -6 D. -3

2. What is the slope of the graph below?



- A. 3 B. -3 C. $\frac{1}{3}$ D. $-\frac{1}{3}$

3. Given $y = -2x + 3$, find the value of y when $x = 5$.

- A. 13 B. 7 C. -7 D. -1

4. Given $y = -2x + 3$, what is the value of x when $y = 27$?

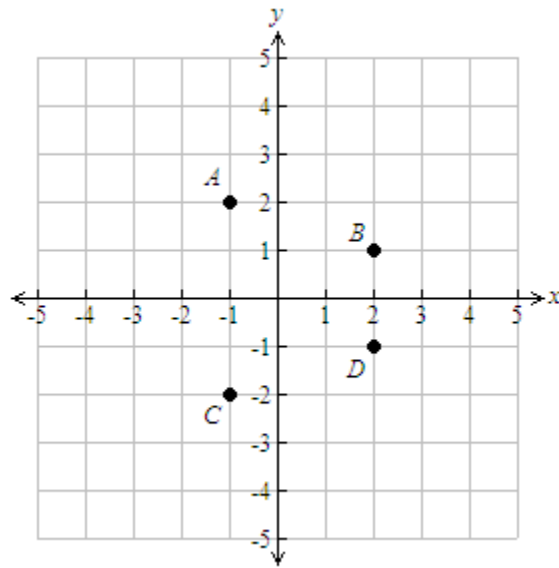
A. -15

B. -12

C. 12

D. 15

5. Which point is the graph of $(-1, 2)$?



What Do You Know?

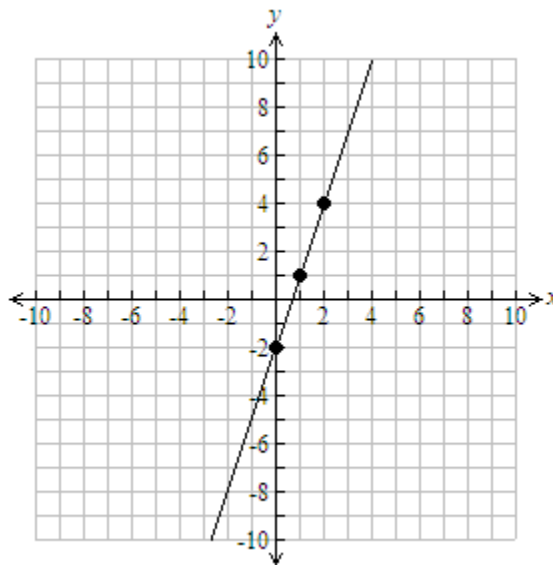
Name: __ANSWER KEY__

1. What is the slope of the table below?

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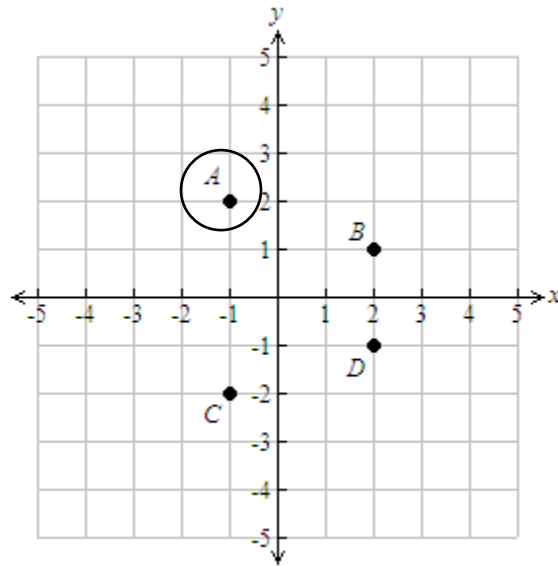
A. -15

B. -12

C. 12

D. 15

5. Which point is the graph of $(-1, 2)$?



Pinch Cards

A

A

A

B

B

B

C

C

C

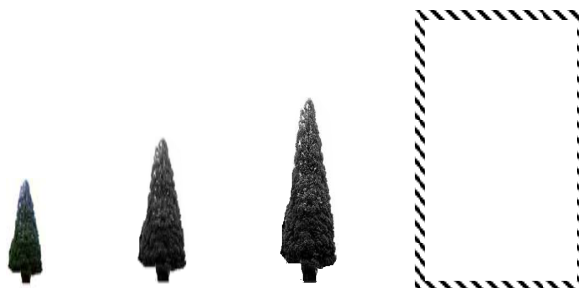
D

D

D

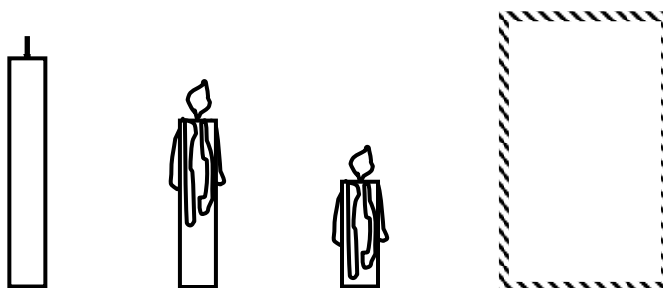
Slope is Change

Name: _____



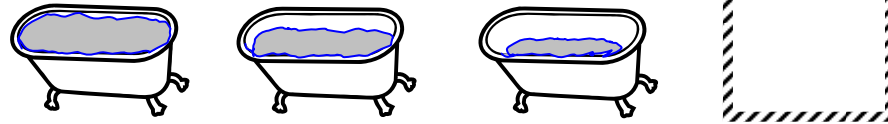
1. **Predict and draw** the next tree in the box provided above.

Describe what is happening to the images.	Explain what is changing.	Analyze what the change depends on.	Justify how and why you drew your prediction.



2. **Predict and draw** the next candle in the box provided above.

Describe what is happening to the images.	Explain what is changing.	Analyze what the change depends on.	Justify how and why you drew your prediction.



3. **Predict and draw** the next bathtub in the box provided above.

Describe what is happening to the images.	Explain what is changing.	Analyze what the change depends on.	Justify how and why you drew your prediction.

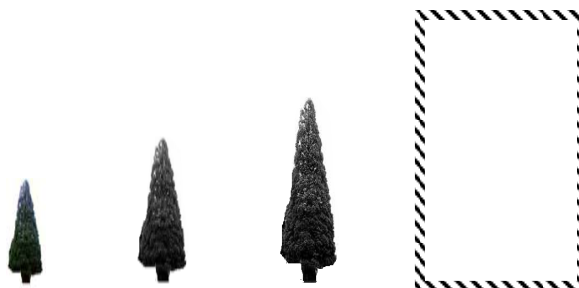


4. **Predict and draw** the next person in the box provided above.

Describe what is happening to the images.	Explain what is changing.	Analyze what the change depends on.	Justify how and why you drew your prediction.

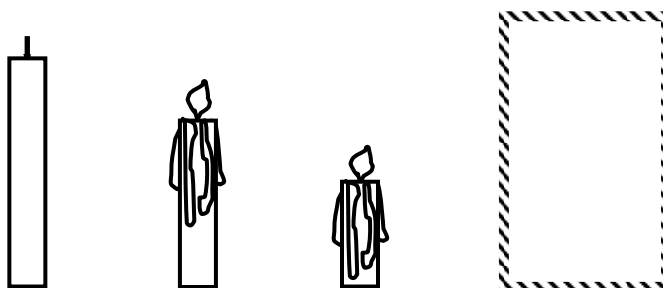
Slope is Change

Name: _____ANSWER KEY_____



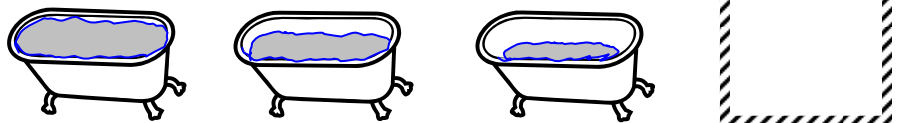
1. **Predict and draw** the next tree in the box provided above.

Describe what is happening to the images.	Explain what is changing.	Analyze what the change depends on.	Justify how and why you drew your prediction.
The trees are getting taller.	The height of the trees are changing.	The change in height depends on the time.	Answers may vary.



2. **Predict and draw** the next candle in the box provided above.

Describe what is happening to the images.	Explain what is changing.	Analyze what the change depends on.	Justify how and why you drew your prediction.
The candle is getting smaller.	The height of the candle is changing.	The height of the candle is changing based on the time.	Answers may vary.



3. **Predict and draw** the next bathtub in the box provided above.

Describe what is happening to the images.	Explain what is changing.	Analyze what the change depends on.	Justify how and why you drew your prediction.
The water level in the tub is decreasing.	The amount of water in the tub is changing.	The amount of water in the tub depends on the time.	Answers may vary.

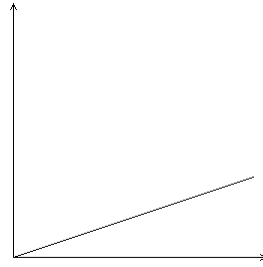


4. **Predict and draw** the next person in the box provided above.

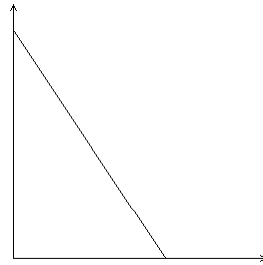
Describe what is happening to the images.	Explain what is changing.	Analyze what the change depends on.	Justify how and why you drew your prediction.
The man is getting taller (older or growing).	The height of the man is changing.	The height of the man is changing depending on time.	Answers may vary.

The Perfect Match

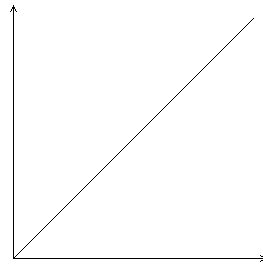
Julie walks to school every day from home.



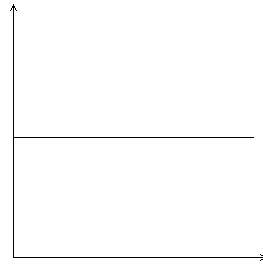
Keith drives home from work at 30 mph.



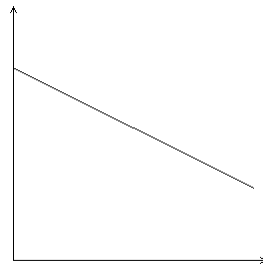
Greg runs to the store from his house.



Kevin was the tallest in his class for 3 years.






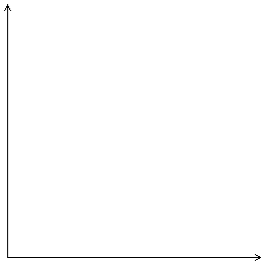
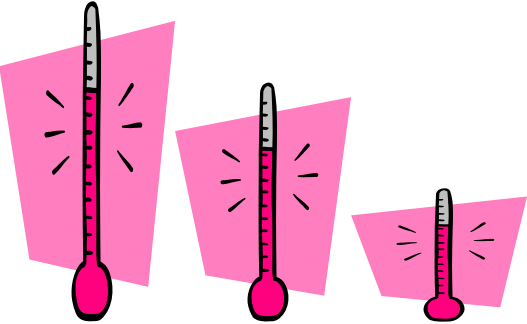
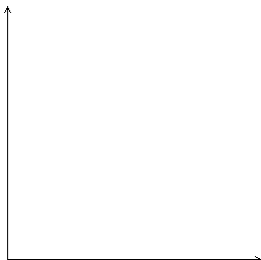
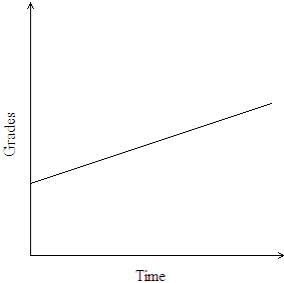
Sasha took \$20 to the arcade to play games that cost \$0.50



Now It's Your Turn.....

Name: _____




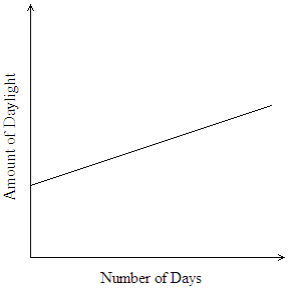
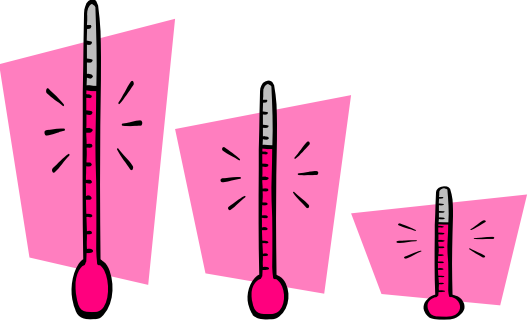
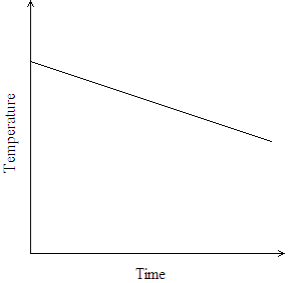
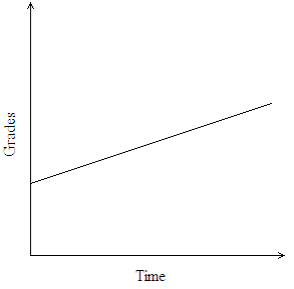
Directions: Complete the table, providing a story, image, and graph for each row.

Story 	Image 	Graph 
<p>In Alaska, the amount of daylight increases by 7 minutes each day during the month of March.</p>		
<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>		
<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>		

Now It's Your Turn.....

Name: ANSWER KEY

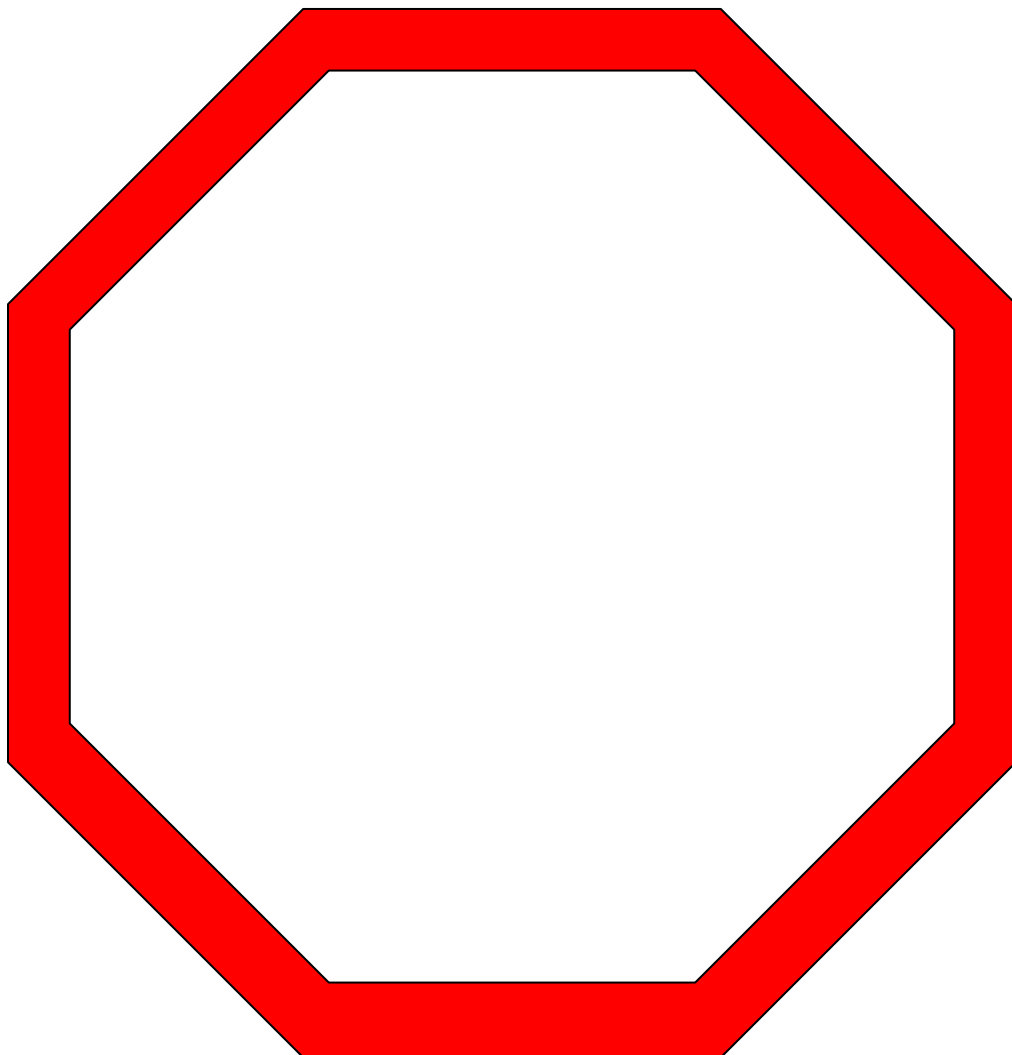
Directions: Complete the table, providing a story, image, and graph for each row.

Story 	Image 	Graph 
<p>In Alaska, the amount of daylight increases by 7 minutes each day during the month of March.</p>	<p>Students may draw pictures such as the sun rising at three different times (or the moon getting lower, which would correspond to a graph with a negative slope).</p>	
<p><u>Students may create any story that includes the temperature decreasing.</u></p>		
<p><u>Students may create any story that includes their grades increasing while time increases (maybe studying or doing homework).</u></p>	<p>Students may draw any picture that indicates grades going up (maybe percentages or letters increasing).</p>	



Before you can leave you must create your own!

Make sure to include a **story**, **images** and a **graph**!



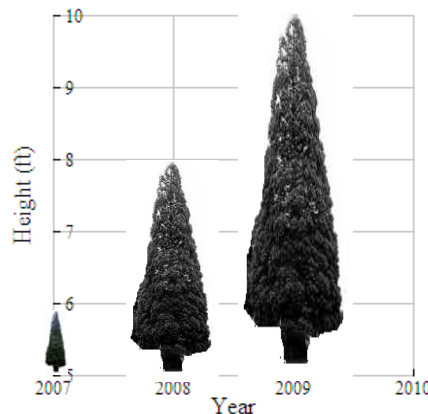
Pictures → Table → Graph → Equation

Name: _____

Adding numbers to the pictures allows for constructing an equation to model each unique situation. These equations can be used to make predictions for the future and analyze the past.

A useful form of a linear equation is the _____ – _____ form ($y =$). In this form, the slope (m) and the y -intercept (b) make graphing and predicting easier. The slope, m , is our rate of change, and the y -intercept, b , is our beginning value.

Example 1: Trees



- Create a word problem that represents the situation pictured above.

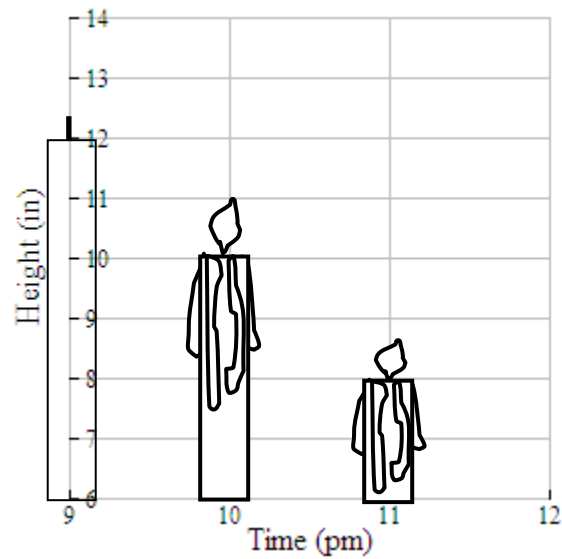
- Make a table to display the data.

Year	Height (ft)

Years Since 2007	Height (ft)

- Determine the beginning value, b .
- Calculate the rate of change, m .
- Write an equation in slope-intercept form to represent this situation.

Example 2: Candles



- Create a word problem that represents the situation pictured above.

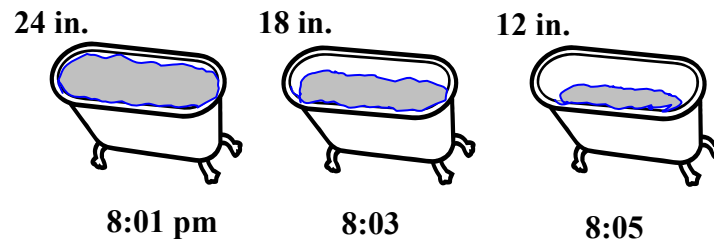
- Make a table to display the data.

Time	Height (in)

Time Since 9pm	Height (in)

- Determine the beginning value, b .
- Calculate the rate of change, m .
- Write an equation in slope-intercept form to represent this situation.

Example 3: Bath Tub



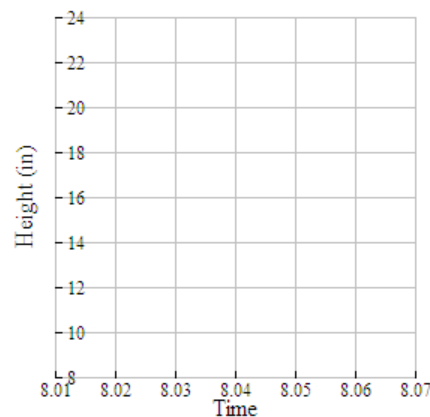
- Create a word problem that represents the situation pictured above.

- Make a table to display the data.

Time	Height (in)

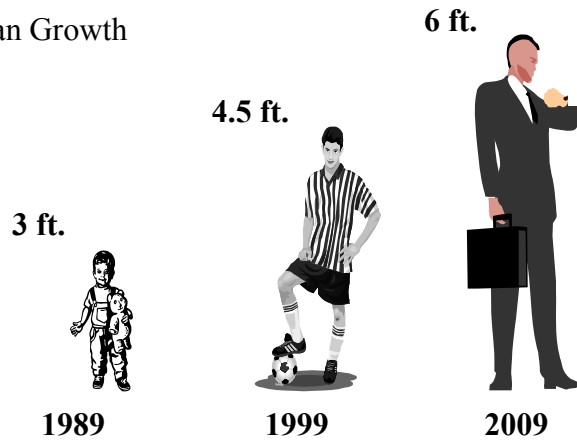
Time Since 8:01	Height (in)

- Plot the data on the graph below.



- Change the scale in the graph above to reflect the second table.
- Determine the beginning value, b .
- Calculate the rate of change, m .
- Write an equation in slope-intercept form to represent this situation.

Example 4: Human Growth



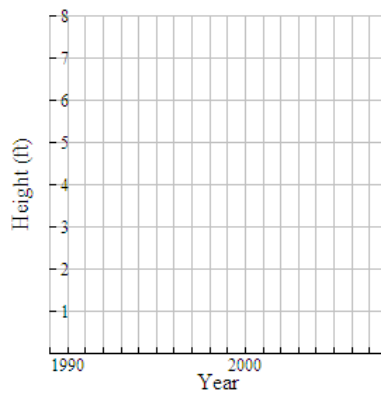
- Create a word problem that represents the situation pictured above.

- Make a table to display the data.

Year	Height (ft)

Year Since 1989	Height (ft)

- Plot the data on the graph below.



- Change the scale in the graph above to reflect the second table.
- Determine the beginning value, b .
- Calculate the rate of change, m .
- Write an equation in slope-intercept form to represent this situation.

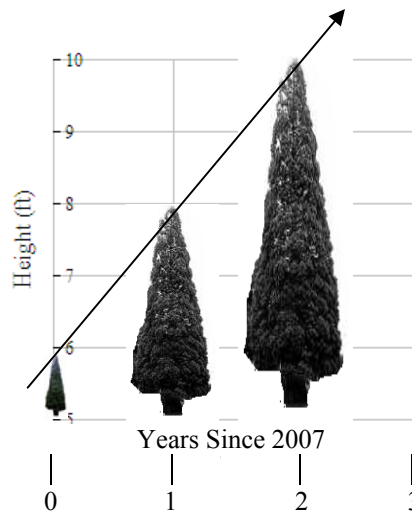
Pictures → Table → Graph → Equation

Name: ____ANSWER KEY____

Adding numbers to the pictures allows for constructing an equation to model each unique situation. These equations can be used to make predictions for the future and analyze the past.

A useful form of a linear equation is the SLOPE–INTERCEPT form ($y =$). In this form, the slope (m) and the y -intercept (b) make graphing and predicting easier. The slope, m , is our rate of change, and the y -intercept, b , is our beginning value.

Example 1: Trees



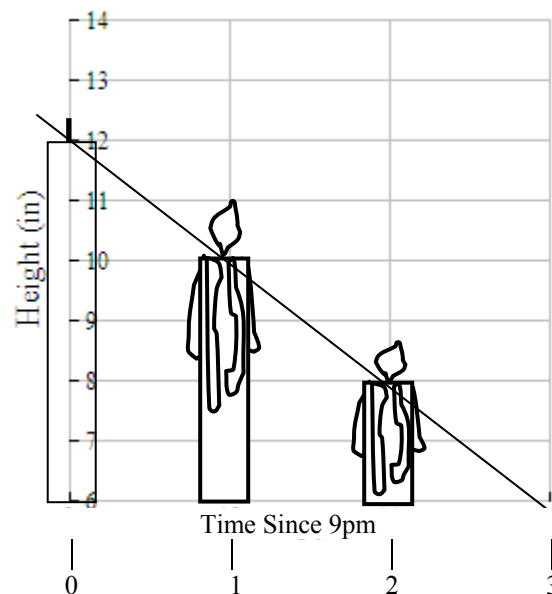
- Create a word problem that represents the situation pictured above.
Answers will vary. Sample Response: In 2007, a forest ranger in Sequoia National Park measured a tree that was 6 feet tall. In 2008 and 2009, the same tree grew to 8 feet and 10 feet, respectively.
- Make a table to display the data.

Year	Height (ft)
2007	6
2008	8
2009	10

Years Since 2007	Height (ft)
0	6
1	8
2	10

- Determine the beginning value, b .
 $b = 6$
- Calculate the rate of change, m .
 $m = 2$
- Write an equation in slope-intercept form to represent this situation.
 $y = 2x + 6$

Example 2: Candles



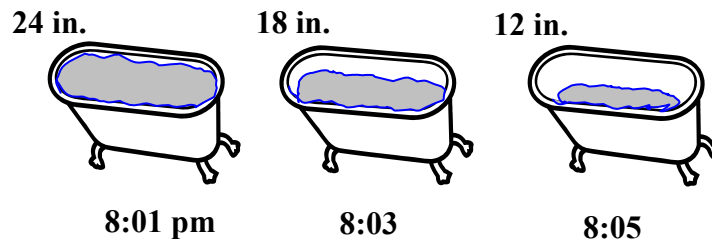
- Create a word problem that represents the situation pictured above.
Answers will vary. Sample Response: The power went out in David's house at 9:00 in the evening. He found and lit a 12 inch long candle to help see in the dark. At 10 and 11, the candle had melted to 10 and 8 inches respectively. Write an equation that models David's melting candle.
- Make a table to display the data.

Time	Height (in)
9	12
10	10
11	8

Time Since 9pm	Height (in)
0	12
1	10
2	8

- Determine the beginning value, b .
 $b = 12$
- Calculate the rate of change, m .
 $m = -2$
- Write an equation in slope-intercept form to represent this situation.
 $y = -2x + 12$

Example 3: Bath Tub

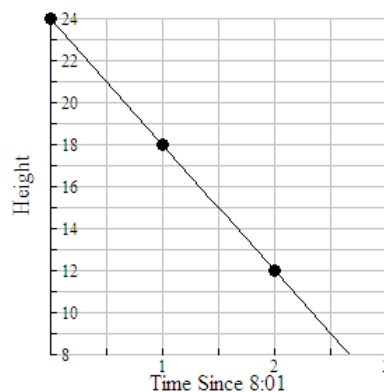


- Create a word problem that represents the situation pictured above.
Answers will vary. Sample Response: Sarah finished her bath at 8:01 on Friday evening and pulled the plug to drain the tub. At that time, the water had a depth of 24 inches.
At 8:03 and 8:05, the water had a depth of 18 and 12 inches, respectively. Write a linear equation that represents Sarah's bathtub draining.
- Make a table to display the data.

Time	Height (in)
8:01	24
8:03	18
8:05	12

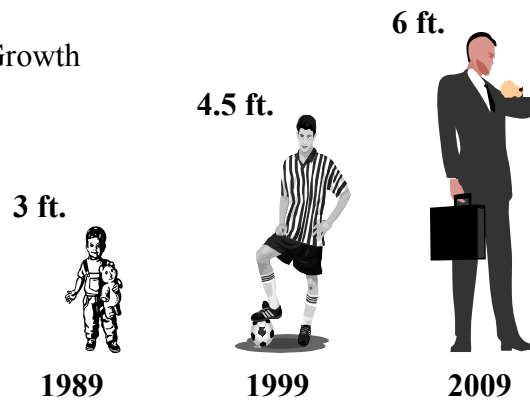
Time Since 8:01	Height (in)
0	24
1	18
2	12

- Plot the data on the graph below.



- Change the scale in the graph above to reflect the second table.
- Determine the beginning value, b .
 $b = 24$
- Calculate the rate of change, m .
 $m = -6$
- Write an equation in slope-intercept form to represent this situation.
 $y = -6x + 24$

Example 4: Human Growth

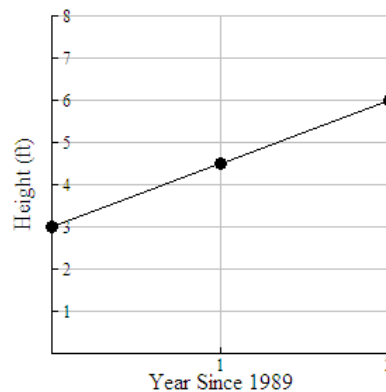


- Create a word problem that represents the situation pictured above.
Answers will vary. Sample response: In 1989, Juan was 3 feet tall. In 1999 and 2009, Juan measured his height again and he was 4 and one half feet and 6 feet, respectively. Write a linear equation that models Juan's change in height from 1989 to 2009.
- Make a table to display the data.

Year	Height (ft)
1989	3
1999	4.5
2009	6

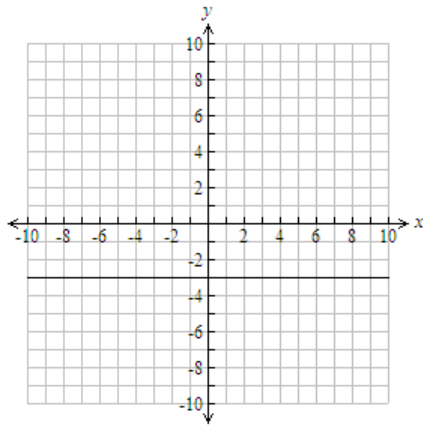
Year Since 1989	Height (ft)
0	3
1	4.5
2	6

- Plot the data on the graph below.



- Change the scale in the graph above to reflect the second table.
- Determine the beginning value, b .
 $b = 3$
- Calculate the rate of change, m .
 $m = 1.5$
- Write an equation in slope-intercept form to represent this situation.
 $y = 1.5x + 3$

Make Me a Match

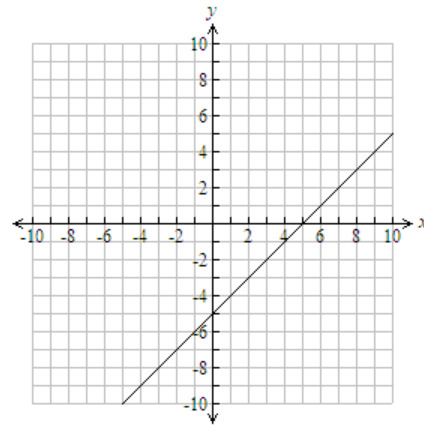


$$y = -3$$

Slope = 0

y-intercept = -3

The temperature in the freezer is always -3°F

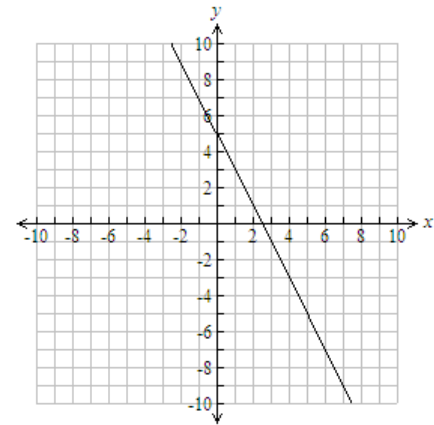


$$y = x - 5$$

Slope = 1

y-intercept = -5

Right now, the frozen turkey is at -5°C . Every 10 minutes, the temperature of the turkey goes up by 1°C

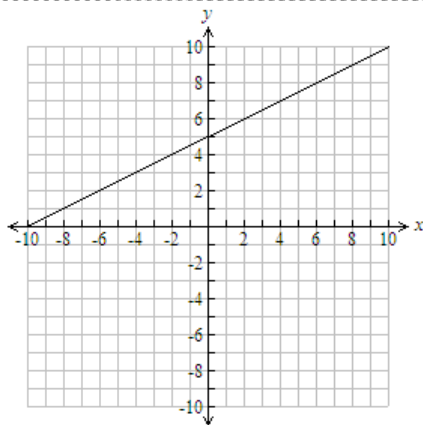


$$y = -2x + 5$$

Slope = -2

y-intercept = 5

Right now, the snail is 5 meters away from home. The snail continues to crawl home at a rate of 2 meters per day.

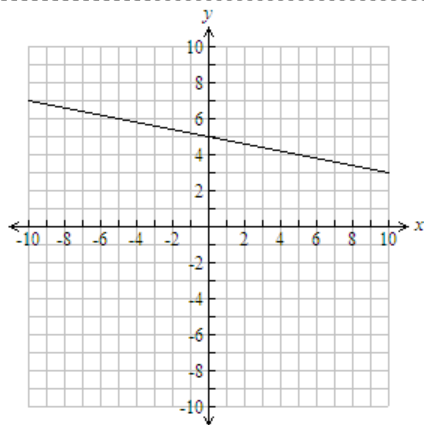


$$y = \frac{1}{2}x + 5$$

$$\text{Slope} = \frac{1}{2}$$

$$y\text{-intercept} = 5$$

Right now, the fox is 5 meters away from home. She is walking away from home at a constant rate of .5 meter per second

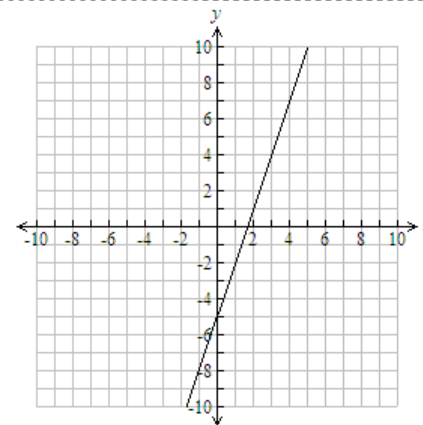


$$y = -\frac{1}{5}x + 5$$

$$\text{Slope} = -\frac{1}{5}$$

$$y\text{-intercept} = 5$$

Right now, the snake is 5 meters away from home. He is slithering home at a rate of .2 meters per second.



$$y = 3x - 5$$

$$\text{Slope} = 3$$

$$y\text{-intercept} = -5$$

Right now, the frozen turkey is at -5°C . Every 10 minutes, the temperature of the turkey goes up by 3°C

Round Table Activity

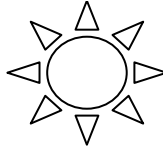
Group Names:

Worksheet A

Person 1

x	y
-2	4
0	12
2	20

Slope:

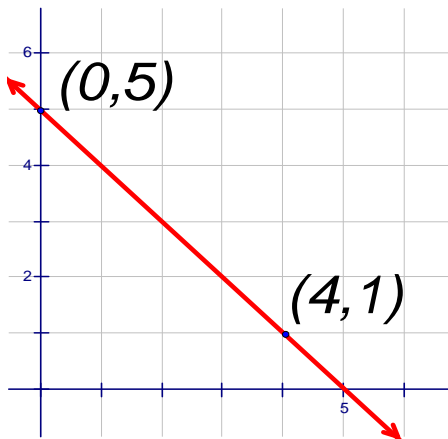


y -intercept:

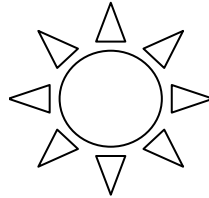


Equation:

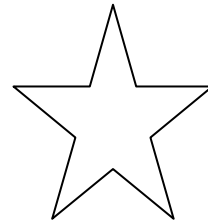
Person 2



Slope:



y -intercept:



Equation:

Person 3

Jeff is starting a savings account for college. His mom gave him \$20 and he saves \$10 each week.

let $x =$

let $y =$

Equation:

Round Table Activity

Group Names:

ANSWER KEY

Worksheet A

Person 1

x	y
-2	4
0	12
2	20

Slope:

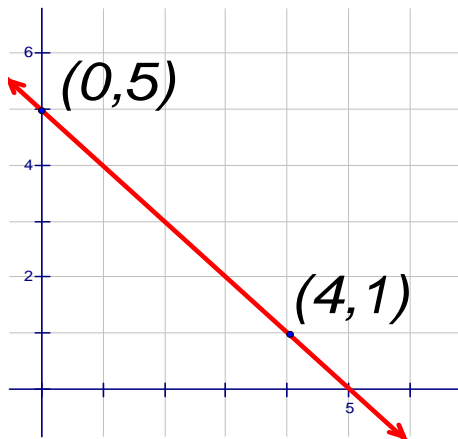


y -intercept:

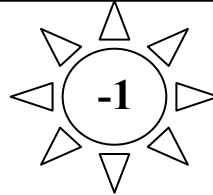


Equation: $y = 4x + 12$

Person 2



Slope:



y -intercept:



Equation: $y = -x + 5$

Person 3

Jeff is starting a savings account for college. His mom gave him \$20 and he saves \$10 each week.

let $x =$

Number of weeks

let $y =$

Money

Equation: $y = 10x + 20$

Round Table Activity

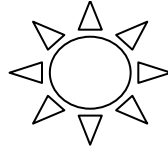
Group Names:

Worksheet B

Person 1

x	y
-3	2
0	8
3	14

Slope:

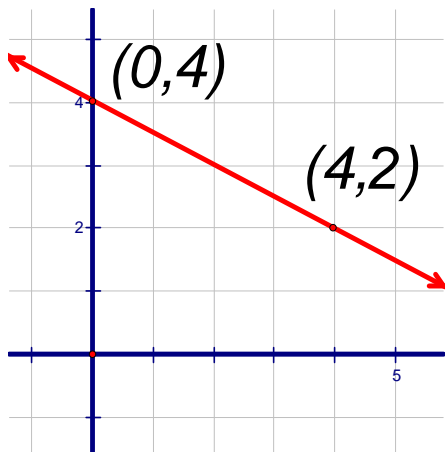


y -intercept:

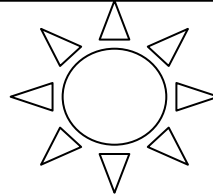


Equation:

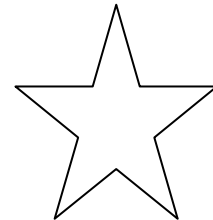
Person 2



Slope:



y -intercept:



Equation:

Person 3

Mary wants a new outfit. Her mom gave her \$25 and she saves \$2 each day.

let $x =$

let $y =$

Equation:

Round Table Activity

Group Names:

ANSWER KEY

Worksheet B

Person 1

x	y
-3	2
0	8
3	14

Slope:

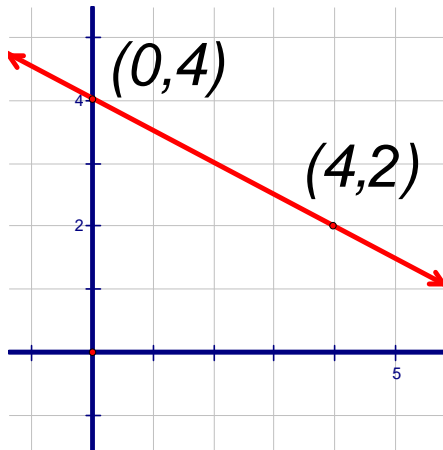


y -intercept:

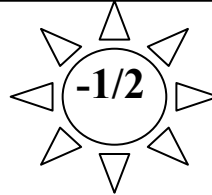


Equation: $y = 2x + 8$

Person 2



Slope:



y -intercept:



Equation: $y = -1/2x + 4$

Person 3

Mary wants a new outfit. Her mom gave her \$25 and she saves \$2 each day.

let x =
**Number
of days**

let y =
Money

Equation: $y = 2x + 25$

Round Table Activity

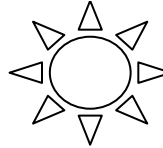
Group Names:

Worksheet C

Person 1

x	y
-1	5
0	3
1	1

Slope:

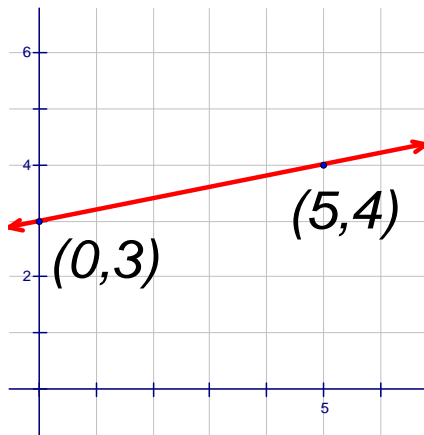


y -intercept:

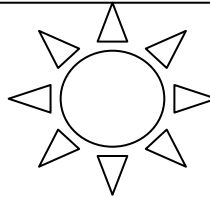


Equation:

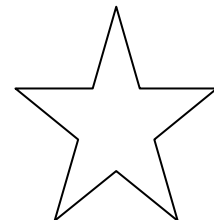
Person 2



Slope:



y -intercept:



Equation:

Person 3

Steven is saving to buy a Playstation. His uncle gave him \$60 and he saves \$20 each month.

let $x =$

let $y =$

Equation:

Round Table Activity

Group Names:

ANSWER KEY

Worksheet C

Person 1

x	y
-1	5
0	3
1	1

Slope:

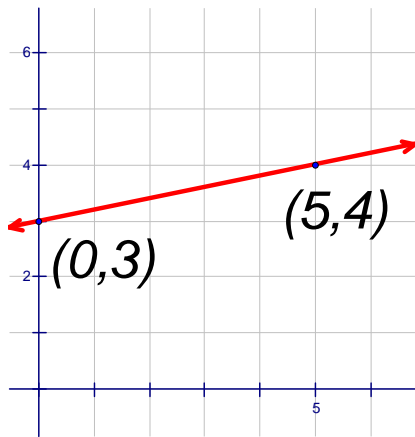


y -intercept:

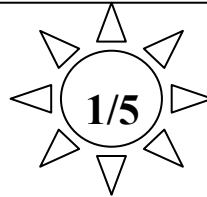


Equation: $y = -2x + 3$

Person 2



Slope:



y -intercept:



Equation: $y = 1/5x + 3$

Person 3

Steven is saving to buy a Playstation. His uncle gave him \$60 and he saves \$20 each month.

let x =
Number
of months

let y =
Money

Equation: $y = 20x + 60$

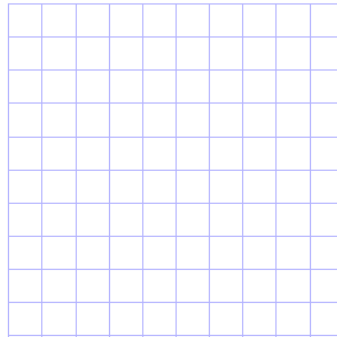
Practice Makes Perfect

Name: _____



Try This: Suppose Michael's swimming workout burns 10 calories per minute. For lunch, Michael consumed 500 calories worth of food. How long would he have to do his swimming workout in order to burn off the calories from lunch?

1. Every year, the school band travels to Spokane for the annual state competition. Right now, the van is currently 350 miles from Spokane and is travelling at an average speed of 70 miles per hour.
 - a) How far will the van be from Spokane in 2 hours?
 - b) How far will the van be from Spokane in x hours? Write an equation.
Let x = number of hours from now
Let y = distance from Spokane in x hours
 - c) Draw a graph that illustrates the equation you wrote in part b. Be sure to label the axes appropriately and use a logical scale.



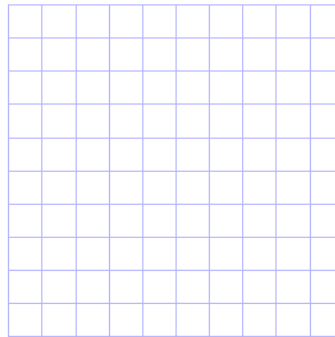
- d) Identify the y -intercept in the graph. Explain what this point means in the context of the original situation.
- e) Identify the x -intercept of your graph. Explain what this point means in the context of the original situation.
- f) How long will it be until the van is 140 miles from Spokane? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

2. A taxi service charges \$4.25 plus \$.35 per mile. Complete the following table:

Miles Traveled	Cost
0	
1	
2	
3	
4	



- a) How much it costs to go 20 miles? Use mathematics to explain your answer. Use words, symbols, or both in your explanation.
- b) How much does it cost to go x miles? Write an algebraic expression:
Let x = number of miles traveled
Let y = cost for going x miles
- c) Draw a graph that illustrates the equation you wrote in part b. Be sure to label the axes appropriately and use a logical scale.



- d) Identify the y -intercept in the graph. Explain what this point means in the context of the original situation.
- e) Find the x -intercept in the graph. Explain why the point does not make sense in the context of the original situation.
- f) If Sam paid a total fare of \$23.15, how many miles did Sam travel in the taxi?

Practice Makes Perfect

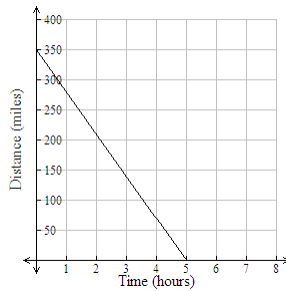
Name: ANSWER KEY



Try This: Suppose Michael's swimming workout burns 10 calories per minute. For lunch, Michael consumed 500 calories worth of food. How long would he have to do his swimming workout in order to burn off the calories from lunch?

$$\frac{500}{10} = 50 \text{ Minutes}$$

1. Every year, the school band travels to Spokane for the annual state competition. Right now, the van is currently 350 miles from Spokane and is travelling at an average speed of 70 miles per hour.
 - a) How far will the van be from Spokane in 2 hours?
In two hours, the van will have traveled 140 miles. So the van will be $350 - 140 = 210$ miles from Spokane.
 - b) How far will the van be from Spokane in x hours? Write an equation.
Let x = number of hours from now
Let y = distance from Spokane in x hours $y = -70x + 350$
 - c) Draw a graph that illustrates the equation you wrote in part b. Be sure to label the axes appropriately and use a logical scale.



- d) Identify the y -intercept in the graph. Explain what this point means in the context of the original situation.
The y -intercept of the graph is $(0, 350)$. This represents the initial value. At the beginning, when $n = 0$, the band is 350 miles from Spokane.
- e) Identify the x -intercept of your graph. Explain what this point means in the context of the original situation.
The x -intercept of the graph is $(5, 0)$. When $y = 0$, the band is in Spokane. The band will arrive in Spokane 5 hours from now.
- f) How long will it be until the van is 140 miles from Spokane? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.
Solving the equation $140 = -70x + 350$ yields $x = 3$. In 3 hours, the van will be 140 miles from Spokane.

2. A taxi service charges \$4.25 plus \$.35 per mile. Complete the following table:

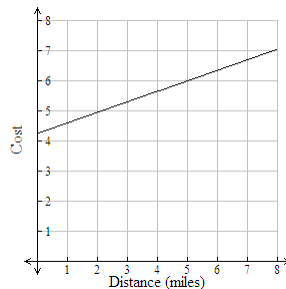
Miles Traveled	Cost
0	\$4.25
1	\$4.60
2	\$4.95
3	\$5.30
4	\$5.65



- a) How much it costs to go 20 miles? Use mathematics to explain your answer. Use words, symbols, or both in your explanation.
The mileage cost will be $$.35 \times 20 = \7 . The total cost to travel 20 miles will be $\$4.25 + \$7 = \$11.25$.

- b) How much does it cost to go x miles? Write an algebraic expression:
Let x = number of miles traveled
Let y = cost for going x miles $y = 0.35x + 4.25$

- c) Draw a graph that illustrates the equation you wrote in part b. Be sure to label the axes appropriately and use a logical scale.



- d) Identify the y -intercept in the graph. Explain what this point means in the context of the original situation.
The y -intercept is $(4.25, 0)$. This is the fixed cost. The cost for simply entering the cab before it takes you anywhere is \$4.25.
- e) Find the x -intercept in the graph. Explain why the point does not make sense in the context of the original situation.
Solving the equation $0 = .35x + 4.25$ yields x is approximately equal to -12.1429 . Negative values for x do not make sense because there cannot be a negative distance.
- f) If Sam paid a total fare of \$23.15, how many miles did Sam travel in the taxi?
Solving the equation $23.15 = .35x + 4.25$ yields $x = 54$. If we travel **54 miles**, the fare is \$23.15.

Student name: _____

Period: _____

Linear Relationship Project

Directions: Find real-life examples of linear relationships. You can use a camera, artistic skills, magazines, newspapers or other media you wish to illustrate this mathematical concept. You must include two examples of each *positive* and *negative slope*. With each example you must write a paragraph describing the situation and what makes it a linear situation. Also, approximate the slope and the y-intercept for each situation and write the equation. Your project could be a PowerPoint, poster, video, etc. Use the rubric to make sure you have all the components of this assignment.

DUE DATE: _____

Component	Points
Neatness/Creativity: is my project clean, neat, colorful and displayed in a creative manner?	/10 points
1st Example of Positive slope: (2 points for each part)	Picture __ Paragraph __ Slope __ Y-intercept __ Equation __ /10 points
2nd Example of Positive slope: (2 points for each part)	Picture __ Paragraph __ Slope __ Y-intercept __ Equation __ /10 points
1st Example of Negative slope: (2 points for each part)	Picture __ Paragraph __ Slope __ Y-intercept __ Equation __ /10 points
2nd Example of Negative slope: (2 points for each part)	Picture __ Paragraph __ Slope __ Y-intercept __ Equation __ /10 points
Total:	/ 50 points

Student name: _____

Period: _____

Linear Relationship Project Brainstorming

Positive Slope

Negative Slope

Round Table Activity

Group Names:

Assessment A

Person 1

Karen walks home from her school that is 60 feet from her house. She walks at a rate of 2 feet per second. The equation $y = -2x + 60$ represents this situation

Can Susan reach home within 18 seconds? Justify.

Person 2

The student government is selling t-shirts to raise money. The equation $y = 5x + 50$ represents this scenario

What does the value of 5 represent?

What does the value of 50 represent?

Person 3

The water level in a tank is 14 feet. Water is released from the tank at a rate of 2 feet per hour. The equation $y = -2x + 14$ models this situation.

When will the tank be empty?

Round Table Activity

Group Names: ANSWER KEY

Assessment A

Person 1

Karen walks home from her school that is 60 feet from her house. She walks at a rate of 2 feet per second. The equation $y = -2x + 60$ represents this situation

Can Susan catch the ball after 18 seconds without jumping?
Justify. $y = -2(18) + 60$ Susan cannot catch the ball after 18
 $y = -36 + 60$ seconds because it is 24 feet in the air
 $y = 24$ feet which is too high for her to reach.

Person 2

The student government is selling t-shirts to raise money. The equation $y = 5x + 50$ represents this scenario

What does the value of 5 represent?
The student government makes \$5 for each t-shirt they sell.

What does the value of 50 represent?
The student government started with \$50 before they sold any t-shirts.

Person 3

The water level in a tank is 14 feet. Water is released from the tank at a rate of 2 feet per hour. The equation $y = -2x + 14$ models this situation.

When will the tank be empty?
 $-2x + 14 = 0$
 $-2x = -14$
 $x = 7$

Round Table Activity

Group Names:

Assessment B

Person 1

Karen walks home from her school that is 60 feet from her house. She walks at a rate of 5 feet per second. . The equation $y = -5x + 60$ represents this situation.

Can Susan catch the ball after 15 seconds without jumping? Justify.

Person 2

The student government is selling t-shirts to raise money. The equation $y = 2x + 75$ represents this scenario.

What does the value of 2 represent?

What does the value of 75 represent?

Person 3

The water level in a tank is 18 feet. Water is released from the tank at a rate of 1 foot per hour. The equation $y = -x + 18$ models this situation.

When will the tank be empty?

Round Table Activity

Group Names: ANSWER KEY

Assessment B

Person 1

Karen walks home from her school that is 60 feet from her house. She walks at a rate of 5 feet per second. The equation $y = -5x + 60$ represents this situation.

Can Susan catch the ball after 15 seconds without jumping? Justify.

$y = -5(15) + 60$	Susan cannot catch the ball after 15
$y = -75 + 60$	seconds because the ball will have
$y = -15$ feet	already hit the ground. (Negative height
	means below the ground).

Person 2

The student government is selling t-shirts to raise money. The equation $y = 2x + 75$ represents this scenario.

What does the value of 2 represent?
The student government makes \$2 for each t-shirt they sell.

What does the value of 75 represent?
The student government started with \$75 before they sold any t-shirts.

Person 3

The water level in a tank is 18 feet. Water is released from the tank at a rate of 1 foot per hour. The equation $y = -x + 18$ models this situation.

When will the tank be empty?

$-x + 18 = 0$	The tank will be
$-x = -18$	empty after 18
$x = 18$	hours.

Round Table Activity

Group Names:

Assessment C

Person 1

Karen walks home from her school that is 60 feet from her house. She walks at a rate of 3 feet per second. The equation $y = -3x + 40$ represents this situation.

Can Susan catch the ball after 13 seconds without jumping? Justify.

Person 2

The student government is selling t-shirts to raise money. The equation $y = 7.50x - 25$ represents this scenario.

What does the value of 7.50 represent?

What does the value of 25 represent?

Person 3

The water level in a tank is 12 feet. Water is released from the tank at a rate of 4 feet per day. The equation $y = -4x + 12$ models this situation.

When will the tank be empty?

Round Table Activity

Group Names: ANSWER KEY

Assessment C

Person 1

Karen walks home from her school that is 60 feet from her house. She walks at a rate of 3 feet per second. The equation $y = -3x + 40$ represents this situation.

Can Susan catch the ball after 13 seconds without jumping?

Justify.

$$y = -3(13) + 40$$

$$y = -39 + 40$$

$$y = 1 \text{ foot}$$

Susan will be able to catch the ball after 13 seconds because it will be 1 foot above the ground.

Person 2

The student government is selling t-shirts to raise money. The equation $y = 7.50x - 25$ represents this scenario.

What does the value of 7.50 represent?
The student government makes \$7.50 per t-shirt sold.

What does the value of 25 represent?
The student government started \$25 in debt (Spent \$25 on making t-shirts.)

Person 3

The water level in a tank is 12 feet. Water is released from the tank at a rate of 4 feet per day. The equation $y = -4x + 12$ models this situation.

When will the tank be empty?

$$-4x + 12 = 0$$

$$-4x = -12$$

$$x = 3$$

The tank will be empty after 3 days.